Conceptualisations

Jeremy GOULD

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Cyrille SIMONNET

Cyrille Simonnet was born in France and lives and teaches in Switzerland at the Institut d'Architecture, Université de Genève. In 1978 he acquired a Diplôme in the History and Theory of Art at L'Ecole des Hautes Etudes. The same year he completed a course in architecture (DPLG) from the School of Architecture in Grenoble. In 1982 he acquired a DEA in the History and Theory of Art from Paris, EHESS. In 1994 he acquired a Doctorat 3ème cycle, in the History of Art, Paris, EHESS. Cyrille Simonnet was involved in archeological excavations in Karnak, Egypt (1978-1980). Between 1988 and 1991 he was a researcher of the Dessin-Chantier Laboratory, of the School of Architecture in Grenoble. Between 1991 and 1994 he was responsible for the Office of Architectural Research of the Ministère de l'Equipement et du Logement. He served as maître assistant, at the Ecole d'Architecture de Grenoble. He is professor at the Institut d'Architecture, Université de Genève since 1996. He is the director of the same Institution since 1998. He was the director of the network of researchers 'cultures constructives', from 1994 until 1998. He is a member of the 'Groupe de Recherche sur l'Architecture et les Insfrastructures' (GRAI), laboratoire de recherche habilité Ministère de la culture, Versailles. He is also member of the comité de rédaction de la revue d'architecture Faces (Switzerland). Cyrille Simonnet has published a number of articles on architecture, the history of construction and the history of building techniques as well as on questions related to the environmental issues of big infrastructures. The most well known of his books are "Le béton armé : origine, invention, esthétique" (300 p. Ed. Parenthèses, 2001) and "L'architecture, ou la fiction constructive » (180 p. Ed. de la Passion, 2001).

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** The keynote speakers appear with the order they intervened.*

Poetry and Plumbing- Reality and Dreams

Jeremy GOULD

In this essay I treat ...[matters of architectural education] ... as what economists call a 'stylised fact'. The term has two closely related meanings. On the one hand, a stylised fact is a simplified picture which captures important elements of what is going on, without going into details. In addition, stylised facts are taken to be true for the purposes of a discussion. They are not real facts that come from compiling actual observations. But they are believed to be reasonably accurate summaries for the purposes of analysis. If one did go out and find the facts, something closely resembling the stylised facts is what we believe we would find.

Max Steuer Urban Sprawl
A Philosophical Investigation. London: LSE 2002.

1. Crises in 20th Century Architecture

20th Century 'modernism' divorced aesthetics from materials or construction.

Before the 20th Century most buildings used existing, tried and tested building techniques (with the exception of long span or tall structures in iron and steel and, later, concrete). Modernism deliberately, as part of its programme, used new materials which were by definition untested and untried or used 'old', 'traditional' materials in new, unconventional ways.

Peter Smithson defined some of the characteristics of Modernism (The International Style) as:

- *Was usually white or brightly coloured, or made of shiny materials*
- *Natural materials when used, appear to be substitutes for artificial materials not yet invented.* (*AD* Dec 1965 p.590)

20th Century architecture leaks. 20th Century architecture falls to pieces. So do all architectures – it keeps many of us in business – but modern architecture does it 'better' than that of any previous style or period.

The failures may be characterised thus:

- Technical failures of materials and components. For example: flat roofs, cladding panels, glass breaking, windows rusting etc.
- Failures due to building physics. For example: heating systems not working, overheating due to the solar gain, air conditioning not working, interiors to bright (glaring), failures of acoustics both internally and externally.
- Failures due to energy consumption and high embodied energy. For example: buildings use about half of fossil fuel energy sources just to make them work.
- Failures due to the incorporation of chemically dangerous materials. For example: PVCs, asbestos fibres, fibreglass. It is extremely difficult and expensive to re-use the materials of modern building.
- Failures due to un-adaptable building forms. For example, in adapting deep plans to new uses OR changing the use of multi-storey buildings. Some building forms are *per se* unadaptable and can only be changed by complete removal.

To these obvious failures, we may add the less obvious ones which are less easy to characterise: For example:

- Sociological failures. That 20th Century architecture and town planning has done more harm than good to 20th Century society. For example in the building of tower blocks to 'solve' housing problems.
- Aesthetic failures. That 20th Century architecture and town planning is significantly uglier than the architecture of previous centuries. That Modern architecture is disliked by contemporary society more than it was disliked by any previous generations. Worse, it is within the programmes of some architectural 'movements' and some practising architects to deliberately be 'ugly'. For example: the Bowelists and the Brutalists or in the recent work of Rem Koolhass or Jean Nouvel and their need to *épater les bourgeois.* The 20th Century has produced more bad architecture than any previous century.

2. Crises in the Construction Industry

One can reasonably identify the end of the First World War as the beginning of the crisis in the construction industry. In Europe, at least, up to that date the construction industry was based on craft skills – mason, joiner, carpenter, roofer, plasterer etc. – which were learnt by long and thorough apprenticeships. Skills almost always ran in families and protection of those skills and standards was controlled by Guilds or Unions.

After 1919, the principles of Taylorism (as promoted by American industry and in particular Henry Ford) were gradually applied to the building industry. It was an easy target – at least one generation of young men had been removed by the War and Europe, still the centre of the economic world, was in political chaos. Although industrialisation, mechanisation and, worst of all, prefabrication were not new (they were 19th Century inventions) their concentration on an underskilled, unorganised, un-unified construction industry changed it forever.

The chief result was that craft skills became divorced from the product (architecture) and its materials. A separate, industrialised and mechanised building products industry emerged that was geared to *selling* product for profit for the benefit of financial shareholders. Almost by definition these products were untested (one could not afford to test them) and designed by engineers who had no knowledge of the building industry and its labour. Products were sold on price, a promise of performance and, often, because they were applied by unskilled or semi-skilled labour.

Curiously, and completely co-incidentally, these products and this organisation of the building industry ideally suited Modernism as opposed to any other, more traditional contemporary movements. It explains why Neo-Georgian or Arts and Crafts architecture faded away in England and most of Europe after the First World War. And it explains much of the ideology and rhetoric of the Modern Movement – for example, Gropius' theories of industrialisation and prefabrication expounded at the Dessau Bauhaus and, by a quirk of history, disseminated across the world by the closure of that small design school by the Nazis.

Since the second World War and through the late twentieth century the building products industry has further consolidated and has become part of a global economy. These firms were often bought for their assets alone – buildings or, more usually, land – which has resulted in less choice and more universality. It is possible to buy the same concrete roof tiles in Britain, the Continent, Thailand and Australia, for example. The brands are owned by the likes of Lord Hanson in the UK and Bouygues in France but EU trading rules enable the products to be available almost universally. Thus the architecture, quite apart from any architectural, climatological or practical reasons becomes more universal.

This consolidation was not until recently apparent in Scandinavia and especially in Sweden. It is interesting to note that traditional skills and the traditional organisation of the construction industry there lasted much longer and well after the establishment of their Welfare State. And it might also me noted that the architecture produced was more popular sociologically, lasted without repair much longer, was significantly different from other European architectures and **did not leak.**

3. Crises in Architectural Education

The end of the First World War was a watershed in architectural education too. The European tradition of being articled to an established 'master' architect gradually changed through the 'twenties for much the same reasons as the building industry was changing. Architectural education became for formalised and regularised, culminating in Britain with the Architects' Registration Act of 1936 which set minimum standards for education and for joining the profession of architecture. It is interesting to note that 'traditional' architects, for example Sir Edwin Lutyens, refused to join the Royal Institute and opposed the Registration Acts whereas the young, modern architects, most of whom has been University trained, joined the Institute as soon as possible after graduating, seeing it as a way of obtaining work and credibility.

Although Continental models varied more widely, more-or-less by the second half of the century most architectural education was channelled to the Universities and by the late century these courses had become full-time rather than part-time. This further divorced architectural training from the practical application of architectural skills in the office. The curricula for architectural training were set by Universities rather than by the profession, architecture became an academic subject rather than a practical one and the connections between training, practice and the building industry became more and more remote. With the current emphasis on 'research' as a way of funding University courses, the connections to practical application become even more difficult. The definitions of 'research' in architecture vary widely – but most universities concentrate on history, aesthetics and architectural theory. Although engineering may have some influence – for example, research into specialist structures – very little research in Universities has anything to do with the construction industry or the building products industry and, even if it did, very little of that research directly touches the lives of undergraduates. The building industry is content to give Universities a wide berth and the Universities are quite happy with this arrangement. How many actual builders have ever appeared in a school of architecture? What research the product industry carries out (in Britain that is less than 0.5% of turnover; in Germany some 5%) it is content to do on its own.

However, happily for us all none of this affects the recruitment into schools of architecture. Whereas engineering, medicine and most science-based courses have problems recruiting, architecture does not even though the course is long and increasingly expensive. There are queues of would-be architects waiting at our doors every September.

I have never seen a proper analysis of their motivations for choosing architecture. It seems that almost all of them are optimistic (definitely an important characteristic for becoming an architect) and intend to become a Sir Norman (Lord) Foster and intend to make lots of money. That the facts to not support either of these aims is of no importance. Money and how to make it is not part of any architectural course I know – in fact, the two things that are never discussed in Schools of Architecture are money and building failures, despite the fact that both of them figure with increasing seriousness in every architectural practice and are increasingly an issue with architectural consumers, the building industry as a whole and with Governmental 'watchdogs'.

The image of the architect and of architecture has remained remarkably stable throughout the twentieth century. The architect is rich, fashionable and in control (and drives a very fast car or, preferably, a helicopter) and architecture looks something like the Barcelona Pavilion or a house by Richard Meier. This is the image most first year students arrive with and the image that many of them leave with some five or six years later, unaltered by anything that has happened to them in between. I do ask students to characterise 'modern' architecture. It is:

- Highly glazed
- Made of panelled, artificial and glossy materials which serve all surfaces
- OR made of concrete which serves all surfaces
- Is white or, when colour is introduced, it is in large planes
- Thin or thin edged
- Floors are probably in polished wood boards; railings and handles are stainless steel
- Flat roofed
- Does not have any pipes, wires or tubes.

The definition is not markedly different from Peter Smithson's of the International Style made in 1965 talking about an architecture defined by Phillip Johnson in 1932.

My version of 'modern' architecture is somewhat different. It is:

- Made of solid surfaces rather than void. Has very little glass, except on the south face
- Is made of materials which have a low embodied energy, are re-usable and not chemically dangerous
- Thick and thick edged
- Has a high thermal capacity
- Materials are carefully chosen for their functions and thus a building may use many materials
- Probably pitched roofed and stores its rainwater
- Is not more than about 12.0 m wide (making it naturally lit and naturally ventilated)
- Has many pipes, wires and tubes.

Of course, they do not believe me and, since I cannot find many examples which fit the definition and none of the current gods – Rem Koolhass, Peter Zumtor, Herzon & de Meuron, Foster, Meier, Tadao Ando and all the rest – are producing architecture which fits the description, I must be wrong. When I show them my 'modern' building, they think that I am joking.

But these lists of architects and their buildings are important in this context. One could argue that these architects' work is important because it resolves the connection between theory and practice. We do admire what architects call the 'detailing'. 'God is in the details', as Louis Sullivan noted, and what we are discussing here is that in most modern buildings the Devil is in the details. In most architecture built before, say, 1914 such connections were assumed – the details are what architects, builders and craftsmen did. Now that is not an assumption, rather it is an exception and one that we celebrate. Having set this up as an ideal, we try to train architecture students to think this way but in the current context this is proving almost impossible. So much so, that many architecture schools have given up any sort of construction teaching, arguing that it is the responsibility of the architectural profession in practice, not the Schools. This is a misunderstanding of what architectural practice is and what architectural practice does; by the time young graduates reach practice it is too late to learn the idea of detailing and that it is design. Most architectural practices have lost this connection and the evidence of this is in the lousy buildings that they produce everywhere. It is not surprising that most new buildings use inappropriate technologies, poor building science and are detailed very badly and ill-trained young architects are not going to change this.

4. Architectural Courses

We are all familiar with the diagrams of the typical architectural course:

We run various courses in drawing (and computers), architectural history, architectural theory (usually 20th Century) and then the 'technical' subjects of structures (structural engineering), building physics (services, heat, light and sound), building construction and building materials. All these courses pump the students full of information which they can regurgitate in examinations at the end of the year. Mostly they pass them because they are not foolish and because we are not foolish – we set exams that they can pass and we can mark and we do not want to chuck them out. We need them more than they need us.

Above all of these runs the most important course of all – Design Studio. This should take up about half of the students' time (in the UK that is a requirement of the RIBA Curriculum) and accounts for more than half of the end-of-year marks. The students realise that this is by far the most important part of the course, it is the part which is by far the most interesting, it is always the part which is best taught and they devote far more time to it than all of the other subjects put together. They devote far more time to it than is 'officially' recognised by the course. In the Studio they develop many different skills – talking, arguing, drawing, model making, working as groups etc. It is here they meet their tutors informally, test their tutors, learn to like and dislike their tutors and begin to understand that architectural course can be fun.

The other courses, particularly the technical courses, are different. They are often taught to strict curricula by formal lectures given by lecturers who do not appear in the Design Studio. Often these lecturers will be reading from standard texts, with standard references and standard illustrations all of which were worked out many years ago and, because of pressures of time and convenience, have not been changed or updated since. They are delivered to a standard timetable in large groups with little time for questions or re-explanation afterwards. They introduce ideas which are completely foreign to the students' previous experience – 'U' values, Newtons, decibels, inverse square laws and the like. The textbooks are dull, difficult to read and out-of-date. Most important, these subjects have no connection to the work in the Design Studio.

Unsurprisingly, the Design Studio is OK the technical lecture courses are not. The message is clear: technology has nothing to do with design.

Typical criticisms of Design Studio work (particularly from those who teach technology) are that it is impractical, not based on any proper analysis of facts, physical conditions, or a client's brief etc., ignores its context, fails to take into account buildability and that it will overheat and leak. The critics might begrudgingly admit that they like the images.

Typical criticisms of Technology work (particularly from those who teach in the Design Studio) are that it is irrelevant, has no practical application, is too difficult for the students to understand, and has not been tested thoroughly and, when tested against the Studio work, the students do not understand the vaguest notions of technology. Of course, the critic does not really know what is going on because he/she does not go to the technology lectures and the information comes second-hand from students sounding off in the Design Studio.

These scenarios are neither helpful nor satisfactory. We also note that the building industry – builders themselves or the makers of building products – have no part in either course.

5. Integrated Design

However, if the Studio is the prototypical model for the architect's design office (or *vice versa*), we know that in architectural practice the opposite is more and more the case. The design of real buildings is more geared to the organisation of the construction industry and products industry than ever before because this is the only practical way to produce a building and it lays off the otherwise unsolvable problem of legal liability. Thus modern buildings are assembled by a contractor or a series of sub-contractors using products produced in separate 'packages'. The architect's role is to choose the packages and co-ordinate them. For example, one will find Lord Foster's or Michael Hopkins' office selecting a window manufacturer to specify, design, manufacture, assemble and guarantee the 'window package' for a building. The architect produces only a theoretical layout drawing and is barely involved in the technology but, of course, has to try to understand it all.

If this is how the industry works, then it would seem reasonable to apply the theory to the Design Studio.

Thus we introduce the idea of Integrated Design where the Design Studio projects are designed to incorporate specific subjects of technology – structures, building construction, materials and building science. This brings the Technology lecturers into the Studio. It makes the Studio teachers address problems of technology. It does not remove the formal lecture programmes (there are still facts that need putting across in that form) although it may simplify them but it does remove the need for examinations since these become part of the Design Studio assessment. Neither does this method mean that all Design Studio work must be done in this way – experience shows that about one third (one project out of three/year lasting, say, 8-10 weeks) is sufficient although more time may have to be allowed for completion of coursework. However, it is made very clear that technology is a design problem.

Of course not all technology subjects can be tested in one project. Design Studio projects need carefully selecting so that they test one or two technical subjects only. The students' pathway through the course needs to be carefully planned so that a minimum range of technical subjects is tackled this way over the two- or three-year course. Also, not all technical subjects need to be tested *within* the Design Studio project programme; it is quite reasonable to set coursework based on a completed Design Studio project at other times so long as the connection with the *design* aspect of the process is stressed. For example, a Studio project may test the construction of a building skin and be concerned with its 'U' value alone. Later, an exercise can be carried out on an overall heat loss/energy calculation for the design with emphasis placed on how the design might change to achieve pre-set criteria. Integrating design into the Studio also allows one to be more broad minded about who one allows into the Studio. If there are specific issues about glass or solar shading, for example, then it is easy to bring the building products industry into the Studio to talk about how it is done. I have organised very good lectures from Pilkingtons on glass, Ibstock on bricks and brickwork and the British Flat Roofing Council on roofing and I would like to encourage students to make more use of the products industry. This has the great advantage of being free and up-to-date but one needs to be very careful that a technical expert is available rather than a salesperson as the principle can be undermined by a poor presentation. We are not used to talking to the industry and the industry is not used to talking to students.

6. Textbooks and References

It becomes increasingly difficult to give students limited and focussed references for technical subjects. As bibliographies become longer and longer, students are less and less inclined to refer to them. They are used to getting small amounts of pre-packaged, accurate information.

Traditionally there were printed textbooks which in Britain were first published in the 1930s as adjuncts to Technical College courses. Although they are still in print in revised editions, they have become dangerously out-of-date and the buildings they illustrate are unappealing. They fail to deal satisfactorily with energy matters, insulation, condensation or vapour transfer. There are many more recent text books published from the 'eighties on which deal with specific technical subjects such as curtain walling, cladding, glass which are more useful but many of them deal with examples (by definition out-of-date examples) rather than stressing principles. It is sometimes difficult for students to decipher these. There is a dearth of good technical textbooks presumably because it has become too expensive and risky for publishers to attempt new publications of this type. Surprisingly, few publishers have attempted to use CD or computer based information and, although some do exist, video film is becoming less used.

Some architectural magazines publish details of the buildings illustrated. These have the advantage of being contemporary which is easier for students to understand than the many published historical examples. In Britain the *Architects' Journal* (unfortunately not the great technical magazine it was 30 years ago) publishes specific details of one element of a building each week. This can be useful and we have run successful First Year programmes analysing these details and building full-size models of them. Better and more comprehensive is the German *Detail* which publishes, in a somewhat icy format, themed volumes on construction techniques with many excellent examples and resumé volumes. *Detail* chooses its buildings well and it remains very popular with students.

In Britain we now have no independent research organisations concerned with the building industry or building products. The Building Research Establishment (now privatised) produces a wide, seemingly random range of research on building failures of all sorts and some good 'how to do it' guides to building elements – floors, walls, roofs etc. This information is geared towards the building industry and not towards students for whom it is unappealing and unfocussed. Such information needs very careful filtering before it is presented to students. I do not think that one can teach building construction by looking at failures – one would not teach design by showing only examples of bad design.

This is also true of Building Regulations and technical standards like the British Standards (DIN). Important and necessary these might be and undergraduates need to know that they exist but more than that they need not know. One needs to teach the principles of some of these subjects only. For example, I teach Fire Regulations by playing a recording of the experiences of survivors from the Manchester air disaster and showing some very scary slides of fires and their aftermath rather than attempting to plod through the dull diagrams in the Regulations. That fire is dangerous and needs to be thought about in design is paramount – the *minutiae* of how one does it can come later.

The conservation industry (which has been hugely boosted by the failures of modern architecture) prints very good textbooks on traditional building techniques. Typically, these are 'how-to-do-it' recipe books (rather like some cookery books) and they are often refreshingly unacademic. For simple forms of building they can be very useful, although they rarely deal with the complex issues of real conservation or modern problems of insulation, isolation or structure.

If the textbooks are out of date, then the manufacturers' technical literature must be a reasonable, and free, alternative. Many manufacturers have greatly improved the quality of their information as they have become responsible in law for the design and performance of their products. Although one needs to be very selective, we now hold a series of manufacturers' catalogues (and CDs) within the Technical Library on reference only. Most of this is very good information giving both theory and practice in easily understood texts and diagrams. For example, Ibstock's catalogue (without pages of coloured pictures of bricks) remains one of the best technical references for brickwork or Rheinzinc's catalogue is superior to any other book on metal roofing. Insulation catalogues often explain the principles of insulation, condensation risk, 'U' value calculation etc. better than any textbook.

Whatever references and information one gives students, it is important to note their reaction to them. In my experience there is no substitute for working out solutions tp the problems and drawing on an overhead projector in coloured pens. Getting the details wrong first time (which one often does) is all part of the fun – it is good for them to see you struggle and to learn that there are not always instant or standard solutions as textbooks tend to suggest.

7. Poetry and Plumbing - Reality and Dreams

I find it useful when talking about technology and construction in architecture to students to talk of poets and plumbers. Students think that they will become poets (and some few will) but all of them will need to become plumbers of some sort and will earn more money as plumbers than as poets. Architecture wobbles uneasily between dream and reality and it is important that we allow students to dream. It is easier to stop them dreaming than to teach them to be good plumbers. I would suggest that the twentieth century did neither the poetry nor the plumbing very well. It is curious that a century that produced so much great literature and so much extraordinary technology did its architecture so badly.

It is reasonable to put at least part of the blame on architecture Schools and architectural education. Since we are not doubting the connection between architectural design, materials and technology, then we have a huge responsibility to teach these subjects properly and thus to change attitudes and the shape of architecture and its usefulness to society.

Slide list

1. *Beauvais Cathedral. Nave.*
2. *Saxe Coburg Place, Edinburgh. 1825.*
3. *Edinburgh. Repairs to stone houses (1992).*
4. *Le Corbusier. Villa Savoie, near Paris. 1929-30.*
5. *Connell & Ward. The Firs, Redhill, Surrey. 1934.*
6. *Yeovil Crematorium, Somerset. c.1960. Flat roof and lead panel failure.*
7. *Richard Meier. Canal +, Paris. 1988.*
8. *Richard Meier. Canal +, Paris. 1988. Cladding panel failure.*
9. *Mario Botta. Médiatheque, Villeurbanne. 1984-88. Rear elevation.*
10. *Mario Botta. Médiatheque, Villeurbanne. 1984-88. Vandalism to stone panels.*
11. *Jourda & Perraudin. Cité Scolaire, Lyon. Falling glass.*
12. *Nicholas Grimshaw & Partners. Waterloo Station, London. Falling glass.*
13. *Duiker, Bijvoet & Wiebenga. Zonnestraal, Hilversum. 1926-31. Ruin.*
14. *Duiker, Bijvoet & Wiebenga. Zonnestraal, Hilversum. 1926-31. Rusting metal windows.*
15. *Jean Nouvel. Arab Institute, Paris. Occuli windows.*
16. *Richard Meier. Art Gallery, Barcelona. 1988. Main elevation with added sunscreens.*
17. *Richard Meier. Art Gallery, Barcelona. 1988. Glare into galleries.*
18. *System flats. Killingworth, Northumberland. c.1970. Now demolished.*
19. *William Chambers and Lord Dorchester. Milton Abbas village, Dorset. 1780. Planned village.*
20. *Perugia. Via della Volte della Pace.*
21. *GLC Architects' Department. Hayward Gallery, London. 1965. Concrete.*
22. *Denys Lasdun. National Theatre, London. c.1968-70. More concrete.*
23. *Eastlake Street car park, Plymouth. c.1970. More concrete.*
24. *Petter & Warren with Lt.Col. Peter Nissen. Council houses, West Camel, Somerset. 1925. Nissen hut structure used as housing.*
25. *Crittall Windows advertisement. September 1938.*
26. *Ruberoid Roofing advertisement. April 1934.*
27. *Walter Gropius. Siemenstadt housing, Berlin. 1930.*
28. *Backström & Reinius. Gröndal housing, Stockholm. 1944 -.*
29. *Helmut Jahn. Portrait.*
30. *Mies van der Rohe. Barcelona Pavilion. 1929.*
31. *Richard Meier. Douglas House, Harbor Springs, Michigan. 1971-73.*
32. *Tadao Ando. Vitra Pavilion, Weil am Rhein, Germany. Concrete wall.*
33. *Gunnar Asplund. Stockholm Public Library. 1920-28. Drinking fountain.*

Construction and Illusion: the Birth of Reinforced Concrete

Cyrille SIMONNET

Construction and illusion : the birth of reinforced concrete

I would like to talk about a problem that could well be the fundamental problem facing our discipline: what is the relationship between architecture and construction? There is no doubt that architecture plays with the appearance of its construction substratum. It is, in a sense, what the philosopher Schelling meant when he said: "architecture is the metaphor of construction". This game, in all its variations, has largely nourished the history of architecture. Perhaps today the issue is not quite as clear-cut as it used to be. In schools, the word "city" seems to be more prominent than "construction". Should this be a matter for concern? The big urban, territorial wave seems to wash away the material and technical concerns peculiar to the art of construction. Planned development, in its broad sense, seems to divorce itself from engineering. Nonetheless, we continue to wonder about it. Creating a project evidently means anticipating a form, a particular use, but it also means (perhaps especially?) anticipating the act of construction. In this sense, the project says something about the future material nature of the construction. It's like a story...

Our task, during these days here, is to question this story. To put it more simply, our task is to share a variety of experiences concerning how the project represents construction. This is why I would like to offer you what I find to be a spectacular illustration of this issue.

I am more of a historian than an architect. I believe that an important event took place at the beginning of the 20th Century when reinforced concrete entered architects' construction culture. I find that this case exemplifies the project/construction issue. Here was a new construction material - a new technology as one would say today - that made its appearance between 1890 and 1900 and was to be extraordinarily successful. At the same time, during the same period, architecture – the theory of architecture – the foundation of the project, then taught at the School of Fine Arts, was going through an unprecedented identity crisis. As we know, the storm of the avant-garde was about to create an upheaval. Today, out of that well-known turbulence emerged the Modern movement, our modern project culture.

In my view, three factors characterise this:

- a separation (one could even say a radical autonomy) of the fields of conception and manufacturing;
- the consequent loss of technical know-how amongst architects;
- a rich exchange with the plastic arts and new attention paid to use.

What is interesting here is the relationship with the technical field. It is how the architectural project both abandoned the material substratum of construction (increasingly left to engineers - the new emblematic figure of modernity), and set the stage for construction, for the materialization of the object. This notion of "setting the stage" is important. It takes place especially through this kind of panoramic opening out towards the plastic arts and the artistic avant-garde. It is perhaps the most famous point in the history of the modern movement, along with the introduction of functionalism.

I think that reinforced concrete is an enlightening example of this issue. Even today, it is the principal construction material. In France, for example, it appears that 80% of the weight of delivered constructions is in concrete and reinforced concrete - and weight is a much more subtle indicator than one would think.

I believe that architecture schools do not pay much attention to this kind of phenomenon. A project seems to be commissioned primarily due to the complexity of the programme or due to the pertinence of a particular situation (urban, visual, topological, etc.), and rarely due to technical necessity. People are no longer sure what it is about, so they deal with it fatalistically, like a negative constraint.

The question I ask myself is the following: how could a radically new construction system, which contradicted a certain number of principles related to project theory, for example the simple idea of "giving shape to ideas", how were architects going to be able to work with a construction material capable of taking on any form, any appearance - a material without a "face"?

Hennebique, for example, one of the most influential people around 1900 in terms of the economic development of the new construction material, sold his process under the unifying slogan of "no more disastrous fires". Behind this slogan, he guaranteed all forms of expression, as if to avoid becoming involved in the actual dynamics of the project – the business of architects. By doing so, he opened up a vast area of contradictions.

For the historian engrossed in this period, there is an astounding kind of paradox. It is just as if this new construction technique (which was to revolutionise 20th Century architecture) was moving forward behind a mask while, at the same time, drawing attention to it. *Larvatus prodeo.*

It was moving forward behind a mask, because reinforced concrete took great care to camouflage itself behind any style or form likely to promote it. The period of eclecticism, an unprecedented stylistic hybrid, was evidently in favour of this deal. One must remember that the architectural project, at the time, had become a fantastic bargaining tool in a commissions market that was becoming more democratic, in which partners were multiplying. The style functioned like a kind of exchange mechanism. In so doing it also created visual models of the construction process, as borne witness by Art Nouveau, the modern style and even, to a certain degree, expressionism in architecture (1900-1920). One must remember that the architectural project, as an economic and technical tool, truly became entrenched at this time.

On the other hand, the new technique (reinforced concrete), was drawing attention to its own mask. What does that mean? It means that this camouflage technique, which I have just mentioned, in fact said more about the camouflage technique than the camouflage itself. Some builders of this period, such as Rabut, Coignet, etc., predicted an aesthetics revolution, which was simply waiting until new artists could make this new material talk. The construction system in a way spilled out of its own mould, despite its low iconicity. Restrained by its timid and unavoidable mimesis, it soon broke away from the argument of form to boast of its structural and economic performances.

This means that construction (here I mean the reinforced concrete system) was breaking away from its project, and was waiting to gain autonomy. In the same way, architectural form gained new autonomy. The autonomy of things technical, as opposed to those of form, was an extremely important moment in terms of our issue (the relationship between construction and project). It is a complex and fascinating story, which I would simply like to express here through a kind of visual adventure: that of photography.

This started with the architects who invented the modern project by disseminating photos of American silos: Gropius in 1913, Le Corbusier in 1920, Moisei Guinzburg in 1924. Or, to be more exact, it ended with them. For, over the 10 to 15 previous years, there had been an extraordinary effort in terms of visual preparation, in which reinforced concrete (which had no "face", so to say - a total lack of visual identity - and which had been obliged to disguise itself), started to build its new image. An image that the architectural project was finally going to "set to music", while ensuring that the material would be able to pursue its thrust of technical autonomy, almost independently of the new architecture that carried it.

Slides

The publication of Le Corbusier's articles in 1920 in the journal "l'Esprit Nouveau" operated a kind of awareness without precedent. Gropius had published the same photographies in the annals of the Deutscher Werkbund in 1913, but the diffusion was somewhat more confidential. What is important, is the role of reference played by these pictures issued from industrial equipment. The engineer is shown as a kind of model designer. He draws hyperfonctional objects. The aesthetics of these equipments is completely free of any academic restraint.

The silo will constitute one of the fetish objects for this generation of architects. A simple tank of the scale of a building, it is the expression of a new type of monument. These objects can present a variety of typologies. What we have to remember, is the plastic lesson they give. The notion of the *engineer's aesthetics* appears at this period. Simple, legible forms, of which the brief is superposed to the form. The form is the product of the use and the technique.

The water towers (château d'eau in fr.) are equally part of this category of objects. The forms are rigorous. They are generated by a static and functional requirement that is transparent to itself. This simplicity seduces the architects of the new generation. More particularly, these technical programs highlights the structural and constructive dimension of the object. They use a sober, elementary vocabulary, which sometimes is very close to the one sought to be promoted on the artistic scene by the avant garde.

The reinforced concrete is the fetish material of these new industrial equipments. They are scattered on the industrial territory at the end of the nineteenth and at the beginning of the twentieth century, precisely at the moment when the new material start to be spread. But it is not yet diffused among the architects. The concrete is not a material of the architectural project. It is seen first in the great universal exhibitions, as the one in Anvers in 1896 or in Paris in 1900. One knows not how to present it. It is an object of fairs.

The exhibition in Paris in 1900 is important for reinforced concrete. The buildings are large academic compositions, as the Grand Palais, for instance. Most historians consider it a stylistic regression compared to the exhibition of 1900, where the metals was exalted as material. But at the level of the infrastructure, most buildings are realised in reinforced concrete. This exhibition is a typical programme of the double signature architect-engineer, similar to the big train stations of the nineteenth century. Two schemes, two designing methods are superimposed, expressing without ambiguity the radical cultural difference between the two professions. The entire problem resides in the fusion of the two design cultures. I am not sure that this has yet been really achieved.

The problem of the history of reinforced concrete, is that it is cluttered by a few persistent myths. We remember for instance 1855, the date of one of the first patents describing explicitly the use of a framework in a mixture of cement. In reality, during almost twenty years, the reinforced concrete has been "invented" several times, in different places. But the interesting question is not the official paternity. There is, of course, one central person to mention: Hennebique. He is a kind of contractor, a business man, a manager. In 1892 he establishes a patent (with the slogan "no more disastrous fires"), based on a simple and clever system for the use of the framework. It is called the system of the "étrier", the stirrup, efficient both at the technical level (large pliability of configuration) and at the manipulation level (easy, without the necessity of qualified workers). Very quickly, Hennebique stages his system (in this case, a system of exhibition where he shows all the possibilities of use in one piece of work).

Hennebique creates rapidly a strategy of publicity and diffusion of his building system. During the first years of exploitation, the worry of the builder is to touch and convince all building partners, architects as well as enterprise engineers, industrials, building contractors. Another important argument he uses for his customers is monolithism. It is the idea the reinforced concrete is nothing else than a homogenous, solid, stable body, with no articulations... Against the negative fantasy of dislocation, of ruin, he will develop the idea of a continuous material. In this register, the idea of form is less important, all its propaganda circles around principles of economy, of security. The concept of solidity is soon affected, it abandons the domain of visual legitimity. The Classical paradigm, established as shown by Michel Foucault on a certain analogy between real and visual, enters a profound crisis. The modern project in architecture is inscribed in this transformation of values. Reinforced concrete, with its notable argument of monolithism, accelerates this process of change.

I have said that concrete has been invented numerous times in less than ten years. Competing processes multiply, patents follow one another. A certain disorder reigns among the principles of these "systems", not yet regulated, , and, above all, one knows not exactly how to calculate them (before 1900). However, two enterprises distinguish themselves in the beginning of the twentieth century. The german process by Wayss & Freytag, exploiting the Monier system ("Monierbau"), and the french Hennebique process. In this period, "béton armé", reinforced concrete (or even reinforced cement) is a building technique, not an object. It is a process that doesn't yet have any visual propriety, so to say. It is partly for this reason that it doesn't yet attract the interest of architects. Static performances are shown, the work or the use is dissolved as much as possible, as the patent that uses it: a bridge, a bench, a railway crossing, an entire house...

Therefore, the first "architectural" works using the reinforced concrete are usually industrial equipments, or when it is architecture, imitations in the taste of the epoch. The house of Ward for example (USA, 1873), an american builder, entirely in reinforced cement, is a historicist replica without great originality. These works should be ranked in what I would paradoxically call the "non iconic" category. The problem is in fact, for these builders, to find the good visual identity of the material. The industrial schemes are for this reason more interesting, as this Hennebique flour-mill in Nantes (France, 1895). Silos, free floors, central hall, cantilever... are combined exactly following a programme of use establishing alone the rule of composition. The process of design-program evacuates the problematic of resemblance, of visual identity.

If one wants to give a true representation of what reinforced concrete signified at the beginning of the century, one should first eliminate this idea of "what it looks like". This is the whole paradox of this new material in this period. I do not forget our problematic: how this construction can be articulated by the project. It is also a manner to ask ourselves: what should construction look like, if it is in fact "spoken" by the project. The visual problematic is fundamental, but, for the beginning of the century, in particular, it vanishes in front of what constitutes, in my opinion, the most pertinent dimension: where is the true place of "design" in reinforced concrete? These slides give a short-cut towards the answer. The genuine places, where this new language is "spoken", are the research unit and the construction site, with the cement mixer.

Let's return to the concrete "in itself". It is a long story. I would like to signal a singular moment in this story, with the work of a french contractor, François Coignet (father of Edmond, important figure of reinforced concrete). In the 1850ies, Coignet establishes several patents on the application of "agglomerated concrete"- béton aggloméré. He builds among others the church of Vesinet in 1855, near Paris, with his process. What is remarkable, is that he uses several metallic frameworks, without taking measure of the constructive importance. What is for me the most symptomatic in relation to our problematic, is simply the idea of making a patent of a construction system. It is the arrival of the enterprise, in the modern sense, in the building, still traditional in its processes. This will disrupt many situations, with its way of "protecting" an invention. Yet in construction, the frontier between "invention" and "creation" is not very clear. Even the nature of the "design" is not easy to characterise: architectural project? Constructive project? The arrival of the new material will trace an invisible, artificial barrier, sensibly changing the landscape of production from the end of the nineteenth century.

The question of the invention of reinforced concrete, the "real" one, is the object of a certain mythology. Frequently, two names are cited: Lambot in 1855 with his reinforced cement boat, exposed for the first time at the national fair in Paris in 1849. This is the anecdotic dimension of the story. Then the patent of Monier, a gardener, in 1867, for his "horticultural boxes" (flower-tray -?). The destiny of Monier's patent is interesting. He builds many tanks and water conducts, the true economical resource of his system. But, above all, he sells his patent to several partners, of which the german society Wayss & Freytag, that exploits the idea in a different direction than his future concurrent Hennebique. The engineer Mathias Koenen, establishes a calculation on the Monier principle. W&F try to rationalise the use of the constructive system in relation to its real structural and static potentials. In this way, a certain aesthetic of reinforced concrete will be issued from this orientation.

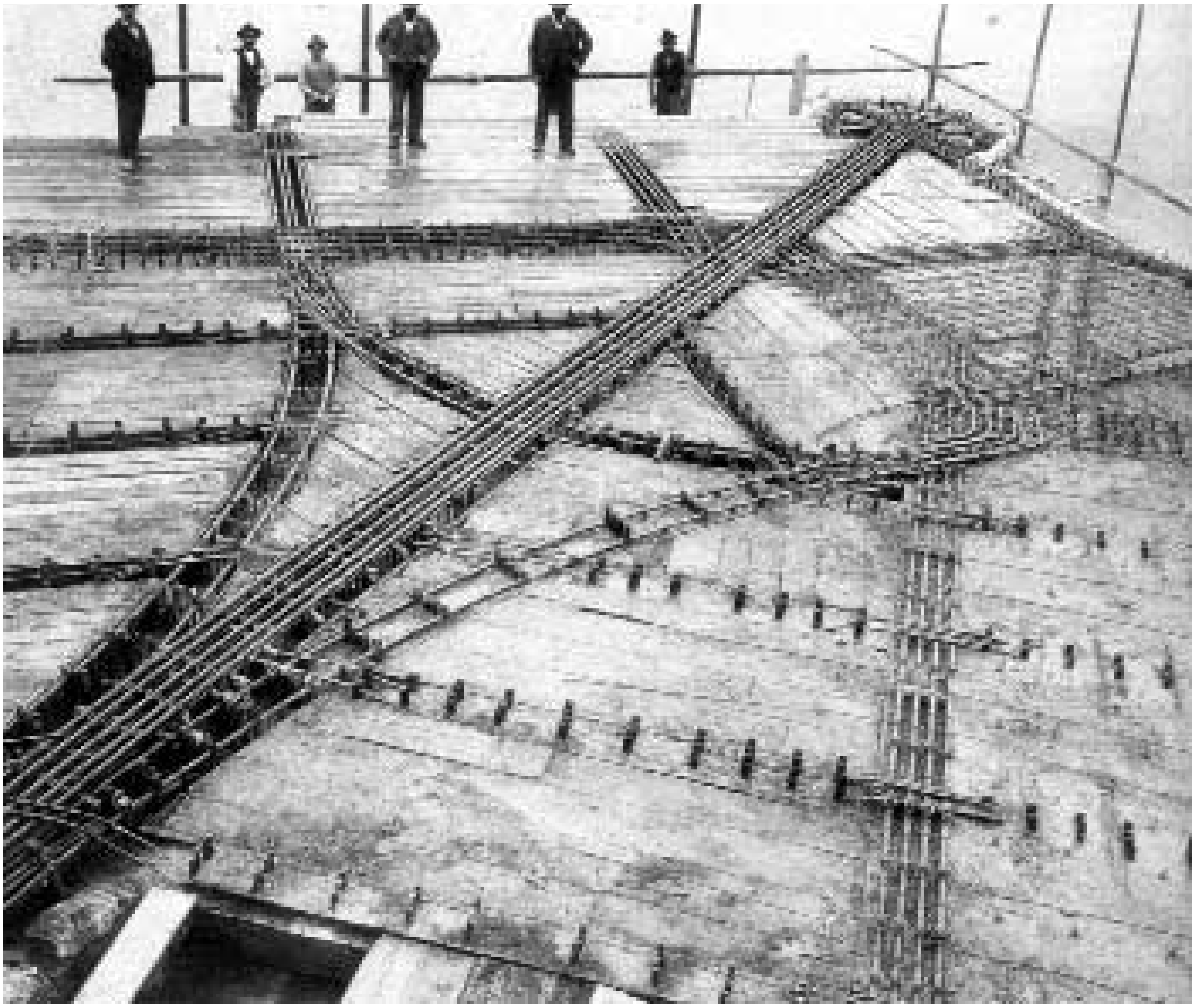
The products issued by the german enterprise will distinguish themselves from those made by the french Hennebique society. At the origin, different "entreprise cultures", tied notably to the exploitation of systems of construction. These two pictures are emblematic of this orientation taken by Wayss & Freytag. To simplify, I would say that the Monier system is based on the slab, whereas the Hennebique system is based on the beam. From the point of view of the calculus and static behaviour, the slab is more difficult to modelise. The Germans will multiply the experiences, and will systematically use calculations. Spectacular, but singular works, will soon

make the success of the german society. As this bridge, exposed in Liège in 1904, a thin arched slab, 6 centimeters thick at the center. Or, later, in 1925, the planetarium in Iéna, the first slim shell in reinforced concrete (6cm thick).

Comparatively, the Hennebique system will develop a completely different strategy of exploitation. Based essentially on a system with a hierarchy of primary and secondary beams, its system will not develop real technical achievements. But it will spread systematically, in the most banal situations. It is often a simple substitute of roof framework, of which traces can, in a certain way, be found in Auguste Perret. It is a tectonic concrete. But its huge success in the industry reveals of its flexibility in adaptation and its real economical performance. The spinning mills, the manufactures, often reduced to superposed floors, are big consumers of the Hennebique system between 1890 and 1920. A particular typology is created, notably in elevation, permitting the clearing of vast lightened spaces.

The spinning mill is without doubt the prototype of the manufactures built with the Hennebique process. This section is interesting. It shows the principal constraints to which the construction should answer. Floors free and lightened, and most of all, capable of resistance to the "shaking" of the machines. The source of energy of the spinning mill is constituted of a vapour machine communicating the movement by "transmissions" that animates the individual sewing machines. A maximum of natural light is required to lighten the working spaces. The typology of this works will constitute a true model for the coming architecture. The large glazed surfaces, the repetitive rythm, the flatness of the facade, the simple prism of the principal volume... The modern doctrine will frequently use this simple vocabulary, essential, hygienic. It is this idea of essentiality, of proximity of a sort of functional origin, not contaminated by forced aesthetic rules, that will seduce the architects of the modern movement.

The reinforced concrete of 1900 does not really have an image. The principal message transmitted by the photographs of reinforced concrete is solidity. But this solidity does not proceed from form, from the design in the sense used in architecture. Numerous documents from this period are representations of proof, of experience. In different situations, here, the stairway of an exhibition pavilion in Paris, 1900, the work is constrained to compulsory weight tests, because there aren't any construction norms with reinforced concrete before 1906. These demonstrative documents are part

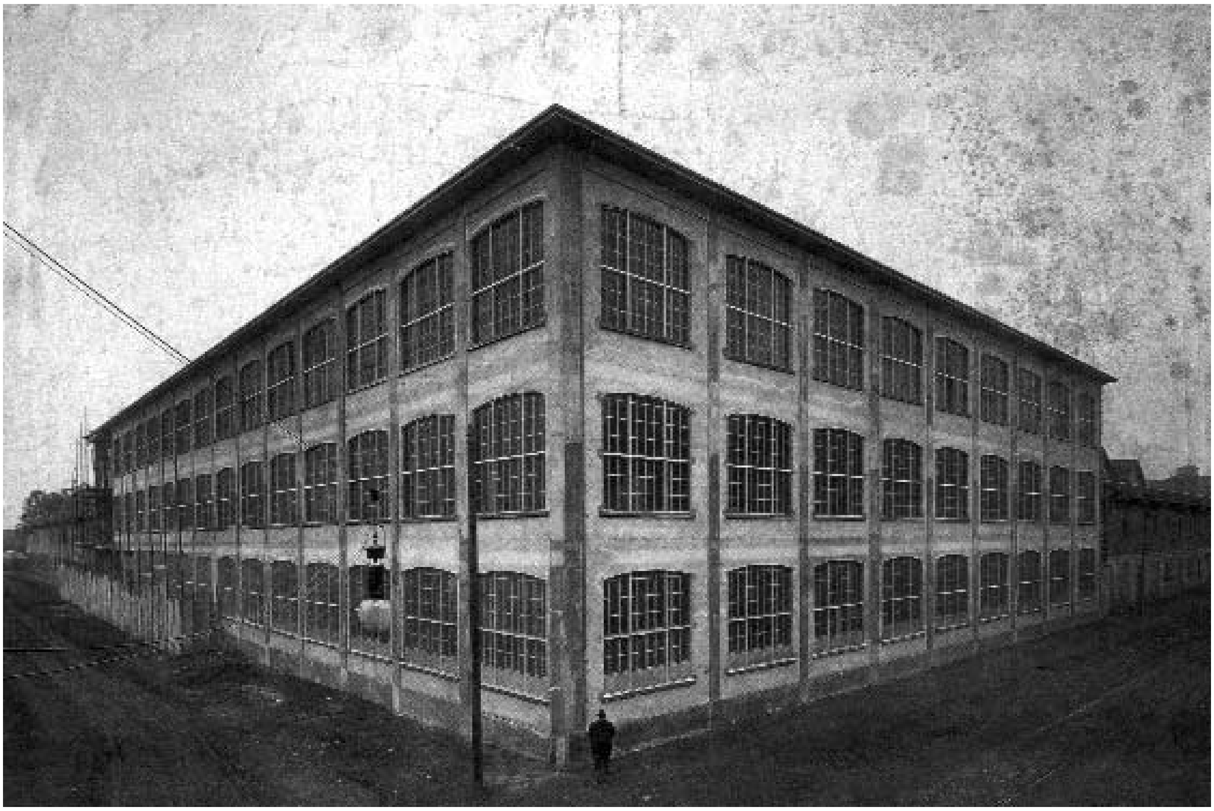


of the commercial strategy of Hennebique. They are made for all the partners of construction.

To understand the mechanism of diffusion of reinforced concrete among the architects and their conversion to this material, let it be considered first of all the commercial strategy of the constructor. Hennebique does not choose pretty objects, spectacular and singular. He asks his agents (exploiters under licence of his system) to systematically photograph the constructions realised with his process and to send the photographs to the central office of the society. Hennebique then makes the promotion of his own system and the enterprise using it. Theoretically, everyone is satisfied, the inventor and the client. In this way, the idea of reinforced concrete start to makes its way, to print itself in the mind of builders and architects. Here, beautiful views of Genova's warehouses around 1900.

In 1900, Hennebique creates his own journal, "Le béton armé" – "Reinforced Concrete", aimed at spreading and valorising its works. The enterprise is overflowing of pictures and letters addressed by its agents, themselves more and more numerous, in France and abroad. This journal is a fabulous springboard for publicity. Even better, it permits to give body, progressively, to the constructive system, that is better identified. In parallel, the Hennebique society organises exhibitions, public demonstrations, "scientific parties". Slowly, we assist at the stage design of this technique which originally was so to say invisible, masked.

It is this process of imaging that seems so interesting to me in our questioning of the relationship between project and construction, design and building. I develop this example because it is, in my opinion, a good demonstration of the difficulty to conceive both the dynamics of form and the proper dynamics of built



matter. Between representation and materiality, there is a chasm. In a certain measure, the photographic mediation will remedy to this inherent difficulty of the new material. In the scape of his journal, Hennebique plays with all parameters of graphical and photographic communication. Tricked pictures, as the setting upright of the mills in Tunis in 1906 after the subsidence, or sequenced and centered pictures, like this experience to fire resistance in Paris in 1900.

Soon, the *Le béton armé* journal, and also the many exhibitions organised by Hennebique, will spread an incredible expressive material, original and varied at the same time. These photographs, at least certain of them, are in my view, true works of art, comparable to the pictures of Atget or Marville. The works presented, vulgar silos or simple test beams, sometimes takes extraordinary dimensions. One really has to read and analyse these pictures. Let us remind that photography is a representational system that is at the same time "evident", directly superposed to its referent, and complex, where stratums of information superimpose in a manner as complex as a literary story.

My hypothesis is that a complex work of information and signification realises itself through the photographic test. In this time, still, the architectural milieu is not open to photography, process as new and original as concrete... Printing, the line, is more convenient to the academic project, still saturated with decoration. Hennebique diffuses without distinction, without hierarchy, all kinds of works, be it construction sites or finished buildings. Traditional references to projects, to the work, to beauty, to convenience are blurred. A new point of view is in the making, combining all values in the same visual surface of photography.

In this way, the view of a floor in the process of execution have the same persuasive force as the view of a finished work, well set in an urban context. Little, by little, the constructive system of reinforced concrete, at the same time very material ("it's mud" – Gromort), and very abstract (it is a system, a process), it "takes" like a mayonnaise, like the paste of concrete itself, it clots, coagulates in a communicable visual regime. It all happens in 1900, 1910. These pictures have fascinatory function, even hallucinatory. It is reinforced concrete that domesticates architects, not the opposite. Because, in a certain way, it is a constructive system that completely escapes them. They appropriate it in the mode of illusion...

This is a series of these photographs, they each would merit a profound analysis, like a painting. The questions of perception, sensation, formal organisation, signification... are mixed. These pictures are extremely built, in the sense that, in 1900 still, view taking is a long, elaborated operation. There is a real project behind each photo.

The metamorphosis takes place in this period. The architects will not know any better what a "project" in reinforced concrete is. But their visual culture will organise this ignorance, if one could say so. It is what I have personally searched to understand by working on this period. One must remember the words of Le Corbusier, Gropius, Mart Stam, Mies van der Rohe even, on reinforced concrete. Magical, incantatory words.

What I would like to call the new constructive culture of architects structures itself in an astonishing process, where the movement of visual appropriation of the new technique superimposes itself to the loss of its traditional technical knowledge. It is complex to explain, but I really believe that something very concrete is happening in this relation between project and construction at this level.

Once again, the photographic medium, in this precise context, is an extremely efficient operator. The ingredients are there: an image of a new type, that can "give", "render" optically, the numerous qualities (or defaults) of the texture; photographed situations that are a direct testimony of the economic modernity; objects without any cultural or academic referent, naked, "truths" in other words; the principle of technical reproduction, to use the term of Walter Benjamin, that permit the circulation of the "aura" of the work.

These pictures could be compared to certain contemporary artistic works. I have talked earlier of this opening to the artistic avant gardes in the twenties. In many views, technical anonymous objects transiting in the societies' journals are unconsciously formulating something of these movements. Giedion had noticed it, he himself uses the term unconscient. A new spatiality, unedited, is invented. In the same way the relation to structure, to line, to plane, to surface, seems to work in a mode similar to certain modern paintings.

I have talked of hallucination about the visual regime specific of photography. I think it is a concept to develop in this context, and even largely in the one of architecture and construction. The fascination, today more that ever, that image produces as conveyed the architectural magazine, testimony again about this strange relation between constructed object and conceived object. From the twenties and on, a new discourse, radical, engaged, will take the relay of this silent speech that is photography. It will be the hour of manifests, the noisy texts of modernity. The project of architecture will at the same time be a project of society. It is the present which is in construction, more than the material work itself.

(Translated from French by Pauline Gjoesteen)

In Detail: How Architects Think about Construction

Susan DAWSON

About Detail

One of the basic questions the workshops are asking is; how do architects learn about construction? Do you start from first principles or/and do you learn from what other architects have done. Working details is about the latter.

Let me explain what working details are. Every week in the AJ we publish a study of a building, complete with plans and sections. The working detail is a double-page of detail drawings which focus on one particular part of that building. It can only be a small part because the drawings have to be at a scale which can be easily read. I establish with the architect which detail to select – a key element like an eaves detail, or a detail such as a staircase which he has spent some time perfecting. The drawings are usually redrawn by the architect to a template provided by me, and I annotate and write a technical description.

What's important is that they are entirely random in content – they absolutely don't attempt to be comprehensive, though I try not to run five staircases in successive weeks. After a year or so I gather the details together and publish them in a book which may grouped the details into walls, roofs or staircases.

And the same goes for the details in the exhibition and the ones I am going to talk about now –this isnt a lecture on construction principles from basement to roof – its about – why does a building look like that and how was it done? In the exhibition Ive tried to show the vast range of details that we cover – from an all-glass porch to the repair of a Victorian railway bridge, and each shows something special and - I hope – demonstrates some area of construction which might be new and interesting to the reader.

What's the Purpose of Working Details?

I'll quote from the preface of the book.

The Working Details are intended to collate ideas about the detailing and construction of buildings; some details demonstrate new and innovative techniques, others refine tried and tested methods of construction. They serve an additional purpose - to enable architects to exchange information on contemporary problems in design. Too many architects, faced with an unfamiliar detailing problem, start afresh - with all the expense of time and energy that that entails - when they could be building on the experience of their fellow professionals.

The interesting aspect of details to me, and the one which I am going to talk about today, is the ideas which drive the details.

Details might articulate the mass of the building, or make it appear less massive.

They might explain the structural behaviour of the building, or not.

They might express or conceal the way in which the building has been assembled.

Is it possible to Design a Detail without a Theory behind it?

1 Here's one I found in a book - the title gives it away Efficient Masonry Housebuilding, - completely sound, utterly boring, what it produces isnt architecture.

2 At the other end of the scale is the building which is full of ideas and no construction sense.

3 This is a project, similar in scale to the one above, by a now well-know architect, a detached house in the country. We published it as an attempt to design a modern house using conventional materials. It looks great but it doesn't work. The architect said to me 'I perceived the brick wall as a skin with the windows proud of the wall.' There are cold bridges everywhere, the only thing that stops rain getting in above the window is a zinc flashing. Rain will puddle on the steel angles, unweathered rails ie no drips. A letter came to the AJ the next week saying –Is this a case of the emperors new clothes? Very embarrassing.

4 Ill pass over that to an architect who really knows about detailing small buildings. Richard Murphy, works in Edinburgh and has written books about Carlo Scarpa, the Italian architect, something of a

cult as one of the great detailers of the modern movement.

5 A modest converted house in an Edinburgh mews. This is in the exhibition. Murphy is exploring several ideas – he's lowered the first floor and made this apparent on the elevation. He's explored the idea that an element performs more than one function, in this case a channel fixed to the front wall carries the first floor joists and indicates the position of the floor, and it also acts as a runner for the wheels of the sliding garage door.

6 The gap between the bottom of the concrete lintel and the new floor level has been filled with two fixed double-glazed units.

He also looks at the idea of the wall as a series of layers, some elements of which are detailed to slide, or appear to slide, behind the others.

A glass block wall appears to be sliding behind the channel; in fact it continues behind it.

Instead of curtains or blinds, two beech-veneered sliding timber screens are set against the inside of the front wall. During the day they are parked between the two windows but at night they slide in opposite directions to conceal the main window and the fixed glazing at skirting level.

The position of the parked screens is 'incompletely expressed' on the front wall by suggestions of what appear to be a single lead-covered panel emerging at the sides of the windows and in front of the skirting level glazing below. In fact it is three projecting nibs fixed outside the glazing, made of lead-clad marine ply with 40mm deep horizontal lead joints. I like the idea of a visual pun.

7 The idea that one component can be used to perform several functions has been taken to its logical end by Norman Foster. Foster's details are the result of continual refinement, research by architect, engineer and manufacturer to produce something which is like piece of engineering – its significant that on a tv programme I saw about architects choosing their favourite buildings, Norman Foster chose a Boeing 707.

The Law faculty building at Cambridge is an example. It's a glass vault, 39metres in diameter and 19metres high, loosely enclosing a four-storey concrete structure. Fosters approach – which he has used on other buildings – is to perfect a very complex junction assembly which can then be repeated all over the façade. The junction here –the meeting of four triangular panes of glass on top of a node where six Vierendeel truss members meet – is pretty amazing. The detail had to accommodate movement and setting out inaccuracies in three directions; the glass appears frameless – in fact the outer sheet projects over the inner sheet to conceal the edge frame; the spaces between the glass act as gutter for rainwater; and there a drained thermal break somewhere inside. Yet from the outside it all appears so simple!

Here is a different idea which has many variations and implications – how to detail the meeting of wall and roof at the eaves. To emphasise the sheltering function of the roof you extend it and let it appear to float over the walls.

Some problems are; if a clerestory runs at the eves how do you detail the structure which supports the roof? Where do the rainwater downpipes go?

The architect Edward Cullinan and the schools designed by Hampshire County Council have developed this idea of the overhanging roof to a fine art. There are three in the exhibition – the Cullinan example is a visitor centre to explain prehistoric earth mound burial sites which itself is roofed with earth – the eaves is a walkway with a glass balustrade which projects to screen the glazed entrance below it. The Hampshire school in the exhibition is a classic – the glulam structure projects beyond the wall to hold up the eaves, there's a delicate louvre screen which modulates sunlight, and the internal gutter rests neatly on paired support beams. This one, and the third, the Cambridge college by Stilwell, are the sort of details I would give gold stars to; they are modest - not flashy, they integrate construction and design elegantly– they make it look easy, of course you know its not.

8 is a Hampshire Count council Sailing club which I want to show you for its brilliant structure. The architect said to the structural engineer – lets not have the same old glulam roof, lets have something that uses baulks of timber, the sort that shipbuilders use, or the ones that get washed up on shore. They came up with the notion of interlocking paired timber members connected only with T-shaped plates to form a faceted roof – its so clever - the T-shaped plate connects the back ends of one pair, the front ends of the next pair and the mid-point of a third pair.

Materials

Im now going to talk about how it is important it is to architects, how it is part of their design philosophy, to use materials – with integrity. 'Truth to materials' is what Michael Hopkins calls it and Glyndebourne is his best example.

9 the brickwork is what brickwork used to be before it became an outer leaf – load-bearing, solid and therefore can be laid in proper English bond. The arches are entirely of tapered bricks – no lintels; the use of lime putty gave a flexibly mortar joint that meant that there were no movement joints - which betray the brick as a skin. The brick piers taper as they rise – no redundancy in the structure – Hopkins did the same with steel columns in his IBM office in Middlesex. Precast concrete beams extend through the brick piers to restrain them and to support intermediate floors.

10 heres a picture of the inside of the opera house where the seating is supported on beautifully detailed precast concrete balconies.

11 Hopkins even specified the type of sand to be used in the precast - a micaceous sand which would sparkle when lit.

Another example of how an analytical approach to a material - in this case concrete – can lead to a new way of detailing it. Office buildings – lightweight structure, with interiors encased in raised access floors, suspended ceilings – air-conditioning because of heat gains everywhere – result -a horrid environment to work in!

12 A solution – concrete structure, solidity can be used as fabric energy storage – heats the building at night and cools it in the day, raised access floor takes all services, ceiling is articulated coffered slab with attractive lighting slotted in the coffer. Rab Bennetts did this at his Powergen headquarters in Coventry.

13 The coffers were cast in GRP moulds – and there are precast slots for partition heads to fit into. It looks a good place to work.

14 I also like the brickwork cladding panels – these don't pretend to be anything else but cladding – they are made of perforated engineering bricks - held by an angle at the base and threaded onto steel rods and post-tensioned so that they could be lifted into position by crane.

15 Small scale –being honest with materials – here is the philosophy of one of my favourite architects – Paul Collinge – he runs a small practice in Oxfordshire.

'I see no separation between concept and detail. Detail is the realisation of a concept; without a concept there is no detail. To me the concept is the core of the design; the detail is one element but it's the most important to realise the design. The two are linked through the process which is reciprocal - going to the detail referring back to the concept, again and again. And unless the concept is clear you do not get a clear result.'

16 Paul Collinge's conservatory illustrates this – the structure is very clear – a sloping roof supported by two timber trees, with a lattice truss at right angles to brace them. I asked Paul why he hadnt used a glulam beam as a brace – he replied that if simple timber sections couldn't do the job he would prefer to change to steel than use a composite. The glass wall and sliding doors are separate from the tree structures – the whole thing is accommodated within the rough and angular rubble walls of an old house.

Next subject – a favourite one of architects and structural engineers together – the staircase. Why – its an opportunity to create something in space, a tour de force. I've done all-glass staircases, folded plate timber staircases, tulip-shaped staircases, etc

17 MacCormac Jamieson Prichard – another small/medium practice who love details. This cantilever staircase structure is particularly interesting as its based on a fairly recent discovery by the engineer Sam Price about Georgian staircase detailing. Georgian stone treads were generally built about 230mm into the brickwork and were rebated at the lower corner where they sat on the next tread down. Obviously these treads are not true cantilevers, so how do they stand up? Sam was designing a staircase of railway sleepers fro furniture designer Ron Arad; the builder slotted the sleepers into holes in a plywood wall and put small wooded packers between them– to his surprise the staircase easily supported two workers. This proved to Sam that the plywood provided torsional restraint to the end of each tread. Here at St. John's college the treads are built into a 100mm wall but they do not rest on each other – each tread is propped by the baluster which extends below it.

18,19 The same principle was used by Michael Squire Associates in their office staircase – the timber treads are connected at their outer ends by a folded steel flat; at their inner ends they are doweled into the supporting wall by two steel pins which carry torsional loads.

20, 21 Ive included this stair by Studio BAAD because of its simple elegance and just to tell you about a practice who make a virtue out of minimal detailing. It's the 'no-detail' detail. This is a really low cost factory building - the staircase had to be enclosed for fire regulations so the walls are lined with galvanised steel and the glass treads are lit from below with metal halide lamps.

22 I like this staircase by van heyningen and Haward for the rigorous way it solves an acoustic problem. There are student rooms on each side of the walls, so the staircase doesnt touch the walls but spans from the landings and half-landings. A diaphragm wall rises between them to carry a disabled chair lift.

I want to finish by quoting Edward Ford, author of one my favourite books, The Details of Modern Architecture Volume 1;

An architect cannot construct a building without a theory of construction, however simple minded that theory might be. Construction is not mathematics; architectural construction is just as subjective a process as is architectural design. Construction involves a more complex set of concerns, the application of scientific laws, and a tradition (or perhaps a conventional wisdom) as to how things ought to be built.